Joint Organizational-Level Automatic Test System IPT Status Brief

06 March 2007

Mission

- Improve the Services' awareness of current OSD policies and initiatives such as CBM+ that aim to transform maintenance processes and practices where cost effective to increase the reliability, availability, and maintainability of weapon systems.

- Partner with industry to demonstrate and advance technologies required to transform O-level maintenance to support current OSD policies and initiatives.

- Actively pursue new joint opportunities for the advancement of Integrated Diagnostics at the O-level and to ensure that the selection, development and introduction of any new O-level ATS is compliant with the ATS Framework.

Joint O-Level ATS IPT

Status:

- Held IPT Meeting at NAVAIR Lakehurst on 13 December 2006.
  - Demonstrated IDATS O-Level diagnostic reasoner and reach-back capabilities to I-level for data mining.
  - Met with ATS Framework Working Group to discuss the 24 Key Elements and their status in the DISR.
  - Agreed focus should be on future DoD maintenance environment and leveraging off efforts of other IPTs to define/recommend standards for O-level test and to prove out new O-level support concepts.
  - Agreed that long term goal should be a ACTD or similar efforts to demonstrate all the various pieces of O-level test (ARGCS ACTD just looking at transfer of O-level maintenance data to I-level).

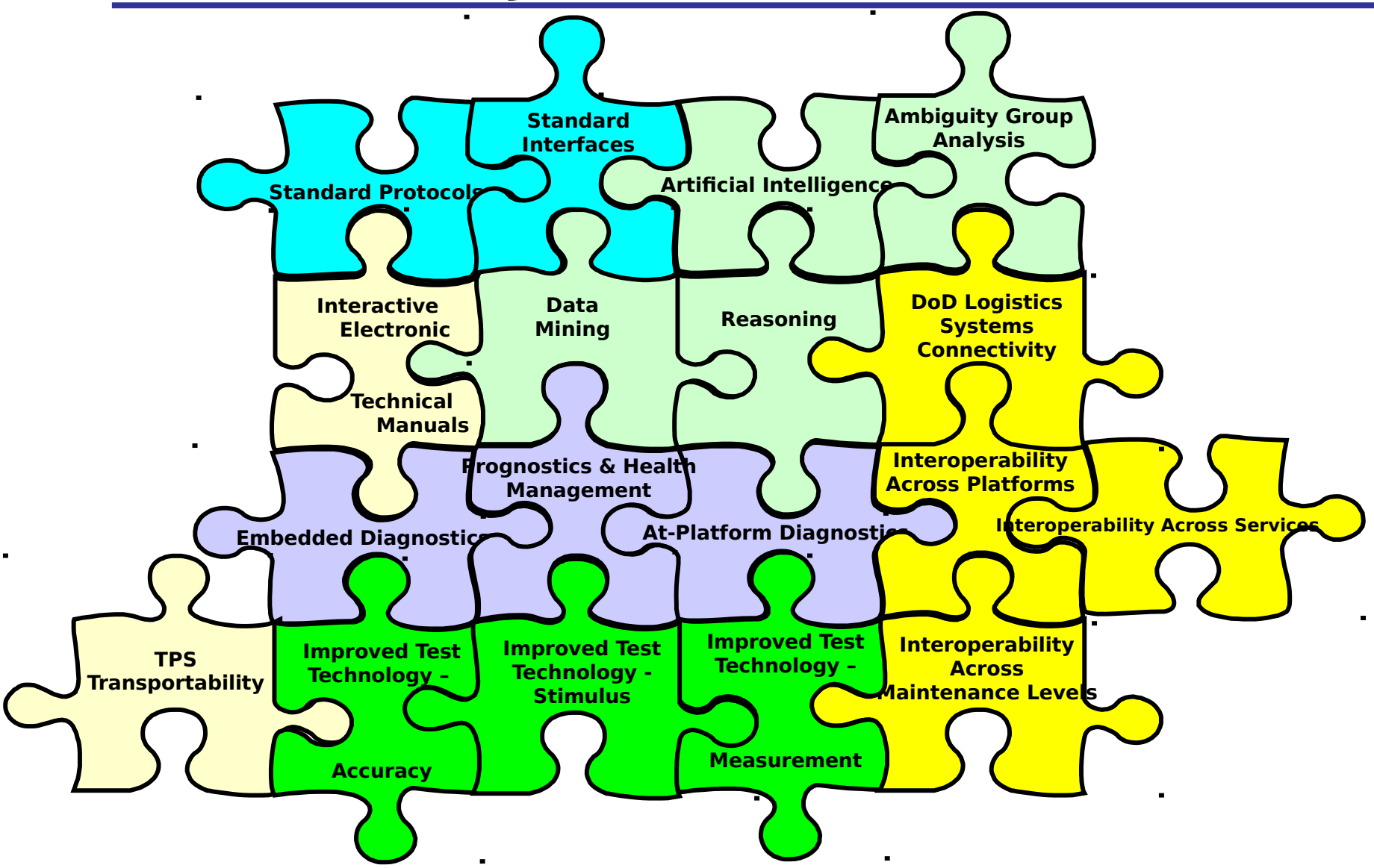
Joint O-Level ATS IPT

Status:

- Created JOLATS “Puzzle” to identify and define all pieces of the O-level maintenance environment.

- Currently mapping JOLATS puzzle pieces to Key Elements of ATS Framework Working Group to ensure that required standards will be put in place and to on-going/planned efforts across DoD that prove out these various puzzle pieces.

The JOLATS Puzzle



Standard (Communication) Protocols

- A standard procedure for regulating data transmission between computers (The American Heritage Dictionary, 2000). Common protocols used within DoD include, but are not limited to:

  - Transfer Control Protocol and Internet Protocol (TCP/IP)
  - (Secure) File Transfer Protocol ([S]FTP)
  - (Secure) Hypertext Transfer Protocol (HTTP[S])
  - Simple Mail Transfer Protocol (SMTP)
  - User Datagram Protocol (UDP)

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Standard Interfaces

- Per MIL-STD-1309D, a shared boundary involving the specification of the interconnection between two pieces of equipment or systems. The specification includes the type, quantity and function of the interconnection circuits and the type and form of signals to be interchanged.

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Embedded Diagnostics

- Per MIL-STD-1309D (embedded test), test hardware and software which is physically enclosed in the end item or permanently attached to it. Any portion of the system's diagnostic capability that is an integral part of the prime system or support system. "Integral" implies that the embedded portion is physically enclosed in the prime system or permanently attached - physically or electronically.

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At-Platform Diagnostics

- Diagnostics performed at the first level of maintenance; i.e., at the weapons system, vehicle, air vehicle, etc. At-platform diagnostics is an iterative process performed as part of the remove-and-replace procedure to verify that a maintenance procedure has reduced or eliminated a diagnostic ambiguity. At-platform diagnostics may be performed automatically through the use of hardware with embedded test software or performed manually by referring to procedures in a technical manual.

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Interactive Electronic Technical Manual

- An Interactive Electronic Technical Manual (IETM) is a representation of a technical manual in digital form. The digital form sometimes includes enhancements such as wire tracing programs or the ability to tie to other diagnostics programs on the host computer.
  - Within DoD, IETMs are assigned to "classes". Classes range from Class 0 (paper) to Class 5, per "DoD Classes of Electronic Technical Manuals" (Jorgensen, NAVSEA Carderock, 1994).
  - The Aerospace Industries Association (comprised of Industry and DoD representatives) has developed the S1000D IETM Functionality Matrix. The matrix standardizes the definitions of IETM capabilities into categories. The categories include Navigation and Tracking, Linking, Updates, Graphics, Diagnostics and Prognostics, Printing, Delivery and Distribution, Access, External Processes, and Special Content.

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Prognostics and Health Management (PHM)

- A diagnostic and prognostic philosophy by which functional capabilities are combined to provide a much larger impact and a broader set of maintenance-oriented benefits than any single function by itself. (Andrew Hess in Intelligent Fault Diagnosis and Prognosis for Engineering Systems, p.xx) Modern PHM systems include many of the following functions.
  - Fault detection
  - Fault isolation
  - Advanced diagnostic technologies
  - Predictive prognostic technologies
  - Useful life remaining, time-to-failure predictions
  - Component life usage tracking
  - Performance degradation trending
  - False-alarm mitigation
  - Health reporting
  - Decision support tools
  - Information fusion and reasoners
  - Information management

- A health management approach utilizing measurements, models, and software to perform incipient fault detection, condition assessment, and failure progression pr

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Artificial Intelligence

- Per IEEE Std100, Artificial Intelligence is:
  - The study of designing computer systems exhibiting the characteristics associated with intelligence in human behavior including understanding language, learning, reasoning from incomplete or uncertain information, and solving problems.
  - The discipline for developing computer systems capable of passing the Turing Test in which behavior of the computer system is indistinguishable from human behavior.
  - The study of problem solving using computational models.

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Data Mining

- The identification or extraction of relationships and patterns from data using computational algorithms to reduce, model, understand, or analyze data. The automated process of turning raw data into useful information by which intelligent computer systems sift and sort through data, with little or no help from humans, to look for patterns or to predict trends. (Science and Technology Dictionary)

- Data mining refers to the statistical analysis techniques used to search through large amounts of data to discover trends or patterns. (Encyclopedia of Intelligence)

- Data mining is the use of automated data analysis techniques to uncover previously undetected relationships among data items.

- The process of automatically searching large volumes of data and the nontrivial extraction of implicit, previously unknown, and potentially useful information from data using techniques such as regression, classification and clustering.

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Reasoning

- The process of automated decision-making using data (such as results from data mining algorithms) along with a structured decision process that contains weighted decision points. Reasoning provides a recommended action based on an input containing a value(s) for known variables contained within the decision process.

- The act of using reason to derive a conclusion from certain premises, using a given methodology.

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Ambiguity Group Analysis

- The process of identifying an ambiguity group and employing additional test resources (e.g., support equipment, historical data, etc.) to further shrink the group, with the goal of reducing the group to one replaceable item.

- MIL-STD-1309D defines an ambiguity group as (1) a group of replaceable items which may have faults resulting in the same fault signature, and (2) the group of items to which a given fault is isolated, any one of which may be the actual faulty item. An ambiguity group is the final resolution of a diagnostic fault isolation procedure. MIL-STD-1309D defines fault isolation as the process of determining the location of a fault to the extent necessary to effect repair.

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Interoperability Across Platforms

- Interoperability of systems to form a system-of-systems which operates across two or more hardware or software platforms.

- MIL-STD-1309D defines interoperability as follows:
  - The ability of systems, units or forces to provide services to and accept services from other systems, units or forces and to use the services so exchanged to enable them to operate effectively together.
  - The condition achieved among communication-electronics equipment when information or services can be exchanged directly and satisfactorily between them and their users. The degree of interoperability should be defined when referring to specific cases.

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Interoperability Across Maintenance Levels

- Interoperability of systems to form a system-of-systems which operates across hardware and software resources at two or more maintenance levels.

- MIL-STD-1309D defines interoperability as follows:
  - The ability of systems, units or forces to provide services to and accept services from other systems, units or forces and to use the services so exchanged to enable them to operate effectively together.
  - The condition achieved among communication-electronics equipment when information or services can be exchanged directly and satisfactorily between them and their users. The degree of interoperability should be defined when referring to specific cases.

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Interoperability Across Services

- Interoperability of systems to form a system-of-systems which operates across hardware and software resources owned and operated by one or more US military services.

- MIL-STD-1309D defines interoperability as follows:
  - The ability of systems, units or forces to provide services to and accept services from other systems, units or forces and to use the services so exchanged to enable them to operate effectively together.
  - The condition achieved among communication-electronics equipment when information or services can be exchanged directly and satisfactorily between them and their users. The degree of interoperability should be defined when referring to specific cases.

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TPS Transportability

- Per IEEE Std 100, portability of software is synonymous with "transportability". Portability is defined there as
  - The ease with which a system or component can be transferred from one hardware or software environment to another.
  - The ease with which application software and data can be transferred from one application platform to another.
  - The capability of being moved between differing environments without losing the ability to be applied or processed.
  - The capability of being read and/or interpreted by multiple systems.
  - The ease with which software can be transferred from one system or environment to another. A relative measure of effort, inversely proportional to the level of modification required for software to be transferred from one system or environment to anot

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DoD Logistics Systems Connectivity

- The ability of electronic systems used for logistics within the DoD to exchange information regarding maintenance of a system, availability of parts, etc.

- The integration of maintenance activities and logistics activities.

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Improved Test Technology - Measurement

- Advances in technology that provide greater measurement capabilities in a smaller packaging footprint, whereas measurement is defined as follows:

  - Per MIL-STD-1309D and IEEE Std 100, the determination of the magnitude or amount of a quantity by comparison (direct or indirect) with the prototype standards of the system of units employed.

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Improved Test Technology - Stimulus

- Advances in technology that provide greater stimulus capabilities in a smaller packaging footprint, whereas stimulus is defined as follows:
  - Per MIL-STD-1309D, any physical or electrical input applied to a device intended to produce a measurable response.
  - Per IEEE Std 100, any change in signal that affects the controlled variable: for example, a disturbance or a change in reference input.
  - Per IEEE Std 100, the logic states within a pattern that drives a circuit model in simulation, or a unit under test (UUT) on automatic test equipment (ATE).

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Improved Test Technology - Accuracy

- Advances in technology that provide greater accuracies when making measurements or providing stimulus, whereas accuracy is defined as follows:
  - Per MIL-STD-1309D, (1) the quality of freedom from mistake or error, that is, of conformity to truth or to a rule (2) the degree of correctness with which a measured value agrees with the true value.
  - Per IEEE Std 100, (analog computer) conformity of a measured value to an accepted standard value.
  - Per IEEE Std 100, (metric practice) the degree of conformity of a measured or calculated value to some recognized standard or specified value.

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